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Science News x

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. McKeen Cattell and published every Friday by

THE SCIENCE PRESS

Lancaster, Pa. Garrison, N. Y.

New York City: Grand Central Terminal.

Annual Subscription, $6.00. Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the association may be secured from the office of the permanent secretary, in the Smithsonian Institution Building, Washington, D. C.

Entered as second-class matter July 18, 1923, at the Post Office at Lancaster, Pa., under the Act of March 3, 1879.

RECOGNITION OF THE INDIVIDUAL[1]

I DEEPLY appreciate this opportunity for laying before this association certain facts and theories of applied psychology which may have a bearing on the organization of engineering education.

The discovery of the individual and the study of his traits and needs in modern psychology has brought forth a maxim in which I wish to couch my proposition for engineering to-day: "Keep each student busy at his highest natural level of achievement in order that he may be successful, happy and good." This maxim is so pithy and cogent that we can afford to read it and reread it, accenting in turn each individual word, as each word of it stands for a principle and each word charges us with a responsibility. Thus, we may emphasize in reading, each, his, highest, natural, achievement, successful, happy and good.

An attempt to carry out that program will make it necessary to take into account: (1) The selection of the individual; (2) the placement of the individual at entrance; (3) the organization of individual groups; (4) the guidance of the individual; (5) the motivation of the individual; (6) the reward of the individual.

Mass production in education and recognition of the individual are two of the foremost problems in education to-day. They loom up large in contrast, because they seem to involve mutually contradictory problems. It is generally believed that mass methods stamp out the individual or, conversely, that recognition of the individual prevents the use of mass methods. But mass education is forced upon us, and the recognition of the individual with his personal traits, limitations, capacities and aspirations is coming to be a persistent demand.

Facing this situation, I am optimistic, believing that a *large* professional school is a good thing and that it is possible to so radically change from the traditional small college methods of instruction to the methods demanded for mass education that we shall be able to deal with students in very large numbers more effectively, more personally and with more precise recognition of the individual than was ordinarily achieved in the small professional school.

The new day in society and the new day in education is marked by the fact that instead of a mere hit-and-miss growth we are assuming conscious control of the evolution of educational tendencies, of the de-

[1] Address before the Society for the Promotion of Engineering Education, at its meeting in Columbus, Ohio, July, 1924.

velopment of the individual and of the shaping of the needs of society.

I. The Preliminary Selection of the Student: A College Qualifying Examination

The great tragedy of all higher education to-day is the maladjustment, failure and misdirection of the student entering college on the towering and surging wave of "education for democracy." From 5 to 50 per cent. of freshmen fail and are eliminated in the first year. These students are sent back to home and community disgraced and disheartened, and constitute not only an economic waste, but a gross maladjustment of human energies, hopes and ambitions.

For this there is a simple remedy, and that is to develop a nationally standardized college qualifying examination which shall be given at the end of the senior year in all high schools and preparatory schools as a basis of information with reference to fitness for college work. On the basis of this examination parent, pupil and teacher may make a rational estimate about the wisdom of going to college; and this examination, which is given merely for information, will be accompanied by expert analysis and advice in general principles of vocational guidance with reference to the outlook for persons of the various degrees of fitness for higher education.

Such an examination is being developed under a five-year experiment now in progress. Two thousand high school students are examined annually. Prediction of probable success is made and this is correlated with the actual achievement of those who go to college, wherever they go. Thus we shall have a quantitative measure of the degree of precision of our power of prediction. The preliminary findings are exceedingly gratifying in this respect.

This examination will also serve to educate the community to the slogan, "It makes a difference"; it makes a difference whether a student is or is not capable of doing college work. It will serve to encourage and select those who may not be fully aware of their high qualifications, and to discourage and eliminate those who are not fitted, not only on the basis of this examination, but on commonsense observation in daily life, when the principle is once recognized and becomes a part of the neighborhood commonsense. The student will make his decision about going to college on the basis of an inventory of his fitness for college, before he has burned the bridges behind him by actually going to the college or even announced to his friends that he was or was not going.

Now at this stage we can not distinguish between the engineering and other professional or liberal arts students. It is enough to know that that student who is fitted to go to college is encouraged to do so, and that one who is not fit is discouraged on the basis of specific information about fitness for higher education.

II. Placing the Individual: Department Placement Examinations

When the student enters the engineering school, he should be required to take a placement examination in each of the first-year subjects, such as English, chemistry, mathematics. This examination, administered by each of the departments independently, is designed to show: First, the degree of natural aptitude for the particular subject; and, second, the character of preparation in that subject. It will be so prepared as to furnish the most effective introduction to the subject in the form of practical exercises for the first two or three days of the course. It will be of the objective type and can be administered and scored easily, quickly and uniformly by cheap help so that, at the end of these exercises, the instructor will have in hand a rating for semester placement which shall be of as high predictive value as the experience of the entire first term in a heterogeneous group, provided the student is willing to work. The student will have had a most effective introduction to the subject. These examinations will be prepared in small pamphlets and bought by the students like text-books at about ten or fifteen cents apiece. It is desirable that national standards should gradually be developed and furnished in fresh editions annually from the hand of the most expert writer in each of the respective fields.

The use of such placement examinations is absolutely essential if we shall start our student rightly at his natural level for achievement, taking into account natural aptitude and character of preparation in the subject as a basis for determining the pace at which he shall be set to work and the character of his task. The present practice of squeezing into the same form those who are by nature and by training radically different in their equipment and ability for doing the work of a given subject is indefensible.

III. The Natural Grouping of Individuals: Sectioning of Classes

The most wholesome tendency in modern higher education is in the direction of individual instruction or, I should say, the privilege of individual work. In its organized form this takes the character of socialized group instruction, in which there is a natural give-and-take in the struggle for achievement, as in ordinary life, and the student is encouraged to pursue knowledge *actively* instead of having it poured into him as by our present methods. For this we are, however, not quite ready, except in the laboratory subjects, as it calls for a radical reconstruction of our curriculum. As a temporary measure, our

best procedure is to section classes on the basis of ability. After a careful study of all three methods in actual operation, I am convinced that any one of these three methods can be adopted effectively in fundamental courses without increasing the cost of education, and without the much dreaded conflicts between courses, while vastly improving the efficiency and naturalness of the educational process.

Sectioning on the basis of ability was in vogue in the best colleges of the country two generations ago, but was gradually dropped when elective courses were introduced, on the theory that it created conflicts. This theory of conflicts was exploded a few years ago by the discovery that if students, in a given course in which there are two or more instructors, are registered by the hour instead of by the number of the section in parallel sections, interchange of students at a given hour can be made at any time during the semester by the two or more instructors in that hour, without the slightest interference with other departments or other courses in the same department. To illustrate, let us suppose that there is a class of one hundred students in freshman mathematics, and that fifty of them may schedule at 8:00 o'clock and the remaining fifty at 11:00. Then the two instructors in each of these hours may agree that one shall have the better half and the other the poorer half of the class reciting at that hour, and that promotion and demotion between the two sections may be made, and shall be made, on the basis of achievement at any time during the semester. Such sectioning establishes a fair basis for praise and blame, introduces fair standards of achievement and creates a morale in the class. To the poor student it means kindness, comfort, justice and opportunity for relative efficiency and approbation. To the gifted student it is a means of finding himself and being motivated by effective competition, freedom from a dead load, stimulation of initiative and the joy of achievement. This method is now the approved method in the best elementary and secondary schools of the country, and all fundamental college courses are fast coming to that practice.

The method of sectioning combines well with lectures and demonstrations in large divisions, as the students at a given hour may meet in a large division for lectures. In laboratory work, it is however unnecessary, because here we can readily employ the method of the socialized group, allowing each student to work and progress at his natural level of successful achievement, the essential requirements being that about three times the ordinary amount of work shall be mapped out, and that the good students shall be so motivated as to distinguish themselves, both in quantity and quality of work, that the highest 25 or 30 per cent. of the grades shall be given for work clearly above that represented by the highest grade ordinarily given in the unsectioned group.

Sectioning on the basis of ability or individual freedom in the laboratory is, however, of no avail unless instructors adapt their methods and requirements to the radically different abilities now segregated. The procedure in each group, examinations, standards of achievement, sequence of courses for students at different levels, must all be adapted to the new situation. For each of the levels a different quantity of work is mapped out and a different quality of response must be required. At the lowest level there must be patient pedagogical drill on the fundamentals. At the highest level, the atmosphere of the scholar with its freedom, large scope and enthusiasms will prevail.

IV. The Guidance of the Individual: Natural Finishing Places

The societies here represented are primarily concerned with the standard engineering course which has a professional status, but in evaluating the setting of such a course, we must view it in relation to this fact, that the extension of the type of training represented by engineering should be varied in proportion to, first, the needs of society, and, second, the capacity of students for training.

If this is true, other natural finishing levels than that set for the professional course should be provided, some longer and some shorter. Corresponding to the various departments of engineering, there should be junior engineering courses (not necessarily by that name), preferably of two years of a combined trade and cultural character leading to a certificate which would motivate our skilled tradesmen who are reasonably educated for democracy. The automobile mechanic, the head carpenter, the plumber, the road builder and the hundreds of others who now face the alternative of four years or nothing, or a part of four years and disgrace, should in this school find the greatest opportunity that has ever yet been offered for the training of intelligent leadership among tradesmen.

I know there is a skeleton in the closet, but the situation must have an airing, for if we are going to extend higher education for democracy, it can not be done by merely increasing the standard professional group. We must provide other outlets which shall enjoy the favor of occupational sanction. This is different from the ordinary trade school or manual training high school. It is trade education as a part of higher education. I would have these students take the so-called classical high school course and acquire scientific foundations for trade skill at the college level.

While such a trade school will probably be independent of the engineering school, the latter must

function sympathetically in launching and sponsoring the former, and in the development of a good concept of education for skill in applied sciences beyond the high school level, particularly in promoting its certification.

Beyond the first degree in engineering, I would have various stages of specialized training in proportion to the needs for highly specialized experts and their capacity for training, even as far as five years of graduate work.

Now I submit that the lower the finishing place, the more men of that training we need, and the more qualify reasonably for it. In rough figures, we may say that for each engineer who takes five years' post-graduate training, five should take three years and twenty-five should take one year. For every professional engineer of the standard course, we should have from two to five times that many educated tradesfolk with a two-year certificate; for society needs a great many more men of the lower training than it does of the higher, and nature has provided a great many more for educability at the lower level than at the higher.

We as educators can not visualize this profile of distribution without feeling great responsibility for an inventory of our concepts of natural units for education in applied science. We can not guide the mass of youth who clamor for engineering education in the future without taking active steps to assist in the sorting or the progressive selection and elimination for different levels of training in applied sciences.

The recognition of this concept in the organization of training in applied science will have great value for the professional engineering course, in that it will furnish a means for progressive selection *for* and elimination *from* that course, thus securing a better grade of professional students and a motivation for those who are to do graduate work in engineering specialties.

V. Motivating the Individual: Spread of Assignment

The procedures for motivating the individual are countless and should be varied. They may vary with the character of the subject, the character of the instructor, the character of the institution; and it must always be kept in mind that different *levels* of capacity must be appealed to by entirely different principles of motivation. Let me but mention one: the setting out of a task in which there shall be room for spread in achievement in proportion to the spread of capacity in achievement. To take a concrete example, entirely arbitrary: if the standard for achievement in freshman chemistry for the first year is represented by one hundred exercises of a certain degree of difficulty from the old point of view, this must be abandoned and work covering from two to three times that amount must be set out as a possible and desirable goal for achievement, with the expectation that a very small percentage of the class may achieve that goal and that there will be a gradual distribution from this maximum achievement down to the point of failure. If it is announced that this three hundred unit basis represents the scope of the course and that grades will be awarded on the basis of achievement on *this* scale, taking into account the quantity and quality of work, then it will be found that more than 25 per cent. of the class when properly motivated will be distributed between the one hundred and the three hundred units of achievement: that is, above the level of the task ordinarily set for the class.

That this extraordinary enhancement of achievement actually does take place is illustrated in classes in which it has been tried by the fact that (again using figures roughly) where a modern type of examination is given to all levels of the class, and is so arranged that the poorest students can only answer the first few questions, and that the best students will have the real test of their abilities in answering the last and most difficult questions, it will be found necessary to change the passing mark, say, from 70 per cent. to some empirical figure like 25 per cent., assuming that we know and wish to maintain the old standard of fitness for passing. That is, what under the old conditions used to represent 70 per cent., or a passing mark, represents only 25 per cent. on the new scale. This is not lowering the standard of passing, but is raising the standard for achievement and basis for recognition of achievement on the part of the best students.

In my own classes in psychology, for example, all A's and B's (*i.e.*, about 25 per cent.) are given to students whose achievement is clearly beyond the standard of achievement which was expected before the principle of segregation was introduced.

This first principle of motivation, then, of setting out a larger program, furnishing the material for the performance, making it known that grades will be based upon achievement, and that achievement will be measured at the level at which the work has been done, is a principle which can and should be applied in all subjects. In setting out such a program, it should be clearly understood among the students that each will be kept busy at his highest natural level of successful achievement; that there are very great differences in the capacity for achievement; that each will be praised or blamed according as he achieves on the basis of his natural capacity, and that we have frankly given up the idea of bringing them all to the same level. It is important that no student shall be permitted to feel that he is doing extra work when he is actually working at a high level of achievement.

The laboratory, of course, lends itself very freely to this type of procedure, and while there are various methods of laying out the program, it will probably be found in general that the best way is to arrange for each level a series of exercises or tasks, increasing in the order of difficulty so that the whole class is kept together on topics from day to day, and that the spread of achievement will be represented by quantity and quality of work on each topic. This is opposed to the idea, often prevalent, of setting out a mediocre standard and allowing the good students to pass rapidly from topic to topic, thus gaining time. There is no topic in any subject that does not lend itself to various degrees of intensive and effective work, and it is a better test of a good student that he shall have done a higher amount and a better quality of work on every topic than that he shall have passed rapidly over a minimum requirement.

VI. The Reward of the Individual

The greatest reward for a good student is the joy of achievement. If we once liberate the good student, give him facilities and encouragement to work at his natural level of successful achievement, formal and outward marks of distinction will be of little consequence as compared with the deep satisfaction in doing this kind of work. To make this enjoyable, many institutions must, however, change their atmosphere so that both students and faculties will hail the superior student with approbation, instead of looking upon him as a "grade-getter" or a union scale breaker.

Nevertheless, the good student should be entitled to certain rewards. Aside from the privilege of being relieved from learning things that he already knows, doing things that he already knows how to do and marking time for the sake of the order of the class, certain natural rewards would be in place. Under the plan I have advocated, high grades will assume an entirely new meaning, and will in themselves constitute a much desired goal, a reward of honor which requires no special action of the faculty, because high grades under the conditions described will imply that the student has traveled in high sections, covered a much more extensive field and done a far better quality of work than is now ordinarily required.

If honors are to be awarded by the faculty in a professional school, I think that they should be awarded on the basis of ranking of a number of students who have good grades, taking into account, first, the grade; second, the special marks of achievement deserving of recognition, particularly a scholarly attitude; third, balance of activities, representing health, socialization and academic life, and fourth, personality, in the sense in which personality is judged when an engineer is to be employed.

Taking this broader basis into account would protect the institution from making the egregious mistakes that are often made when honors are awarded on the basis of mere school record.

In the above, I have proceeded upon the assumption that students shall be held together during the customary period of four or five years in the regular order of topics and shall all take the same time. This, I think, would be entirely justified when, in the new order of things, the good student can have during these years the most excellent opportunities for natural growth and self-expression.

There is, however, another possibility which I should advocate if we can not recognize motivation on the basis of ability, and that would be to adopt the method of individual instruction, which would enable the student to finish his course in a time somewhat proportionate to his capacity for work. There are many points in favor of this method, aside from the mere justice of it, and many of the difficulties which have seemed to stand in the way are mere bogies. However, if I had my choice, I should take the stand in favor of keeping the student in the engineering course to cover specific subjects in a specific time, and then differentiate the quantity and quality of the work to be done in each topic.

I have spoken as an outsider, as boldly as briefly, on some of the most vital subjects touching engineering education, and have deliberately tried to set forth the ideas in high lights and concrete form, in order that they may be tangible as a basis for discussion. Some of the things I advocate are already coming into general practice. All have been tried in some form. I have sought to find fault with existing conditions in a constructive spirit, and am glad to recognize that engineering draws as high a grade of students as any other profession and is probably better taught. I bring no revolutionary theory or simple solution, but it seems to me that the items I have mentioned are among the next vantage grounds that we might survey in engineering education.

C. E. Seashore

State University of Iowa

SHADED TOPOGRAPHIC MAPS

The latest advance in the art of mapmaking at Washington is seen in certain inch-to-a-mile governmental maps on which the relief, still shown by contour lines as heretofore, is rendered more apparent by the addition of shading. The device is not new: it has been employed, for example, on the 1:100,000 map sheets of Italy published some years ago by the Military Geographical Institute at Florence, and on certain maps of the Rocky Mountain region published by the Geological Survey of Can-

ada; but shading is a rarity on American official maps, and in few if any others yet issued is the shading so delicately treated as on those here to be described.

The maps under consideration are at present in process of more or less experimental production by the Geological Survey under the Interior Department, and by the Corps of Engineers under the War Department, each organization working for its own objects and by its own methods in friendly competition; indeed, some of the engineer officers concerned with the making of the maps had their topographic training as members of the Geological Survey. A first trial was made by both organizations two years ago on the contour map of the Monument Springs quadrangle, Texas; more recent trials, which appear to be in several respects more successful than the first one, are on maps of different quadrangles.

The maps prepared by the Geological Survey are expressively shaded by hand on photographically enlarged prints, as if under a northwestern illumination, the shading being darker where the contours are close together, and lighter where they are open spaced. The shaded map is then reproduced on reduced scale by successive photographic and lithographic processes and printed on the original contour map. It is found desirable that a contour map should be recently printed before the shading is overprinted upon it, in order to avoid inaccuracies of registration that might result from the use of contour maps a year or more old, the paper of which may have shrunk appreciably.

The maps prepared by the Corps of Engineers[1] are reproduced photographically from obliquely illuminated models, the making of each model requiring several processes: first, cutting out successive sheets of cardboard along the contours of a somewhat enlarged original map, the cardboard outside of the contours being used to build up an inverted relief or mold; second, a positive, cast from the mold and reproducing the successive "steps" of the cardboard sheets, is graded with beeswax and tooled to a smooth finish; third, a new mold is made from this positive; fourth, a final positive or model is made from the new mold: it is this model that is then photographed down, under oblique illumination, to the desired scale, and the shades thus secured are printed on the original contour map.

On examining the maps thus produced, it is immediately manifest that they make the relief of the land surface wonderfully clear; indeed, at a little distance it is difficult to believe that the maps are printed on flat paper, so vivid is their model-like appearance. If such maps came into general use, their educational effect on adults as well as on junior students will be geographically most beneficial; for while the appreciative reading of contour maps requires special training, the reading of a shaded map requires only such training as the eye naturally acquires in its everyday experience of illuminated objects. Shaded maps, therefore, teach the facts concerning land forms in an emphatic way that contour maps do not. It will be interesting to learn what response is excited by these excellent maps among the public of the several areas that they represent, as well as in the schools and colleges in other parts of the country where maps are used in teaching.

In the meantime a comparison of the maps thus far issued brings forth some interesting contrasts. The most striking at present is merely a matter of colors employed. The sheets lately published by the Geological Survey for certain quadrangles in Pennsylvania and West Virginia are given an appearance of much delicacy by the use of light tints: the contours are printed in a lighter brown than that used on ordinary maps; the cultural features, including names, are printed in a dark gray instead of in full black as usual; and the shading of the relief is very gently modulated, so gently, indeed, as to give the impression that the map is veiled. A somewhat darker shading might be better.

The engineers' maps for certain quadrangles in California and Washington are more vigorous in appearance: the contours are in strong brown, culture in full black, and the shading is fairly dark: hence the whole effect is bolder than that of the survey sheets, and may give the impression of stronger relief than that possessed by the areas represented. Here a somewhat lighter shading might be recommended. In both sets of maps the presence of contour lines on the illuminated slopes lessens their illumination and thus tends to weaken the impression that is intended to be given; here the pale brown contours of the survey maps are less obvious than the darker brown of the engineers' maps.

The above differences are not inherent. They can be lessened, if desired, by the use of different inks. If the maps are to come into general use, the same color-scheme of shading is evidently desirable for both sets. A more fundamental difference is found in the distribution of the shading. On the survey sheets, the down-slope of a hill or ridge away from the assumed source of illumination is shaded from crest to basal stream line, lighter for gentler slopes, darker for stronger slopes. The other side of the ridge sloping toward the source of light is left unshaded.

[1] An account of the development of these maps has been prepared by Major Albert M. Walker, under the title, "The military map of the future," and published in the *Military Engineer* for September–October, 1923.

But on the engineers' maps, the shade on the non-illuminated down-slope of a ridge is not infrequently continued beyond the basal stream line by the shadow of the ridge on the next up-slope: hence the line of change between shade and illumination does not here always lie along the stream line of a valley bottom; indeed, a subordinate ridge on the non-illuminated slope of a higher ridge may be wholly shadowed in this way. As the contours are somewhat obscured by the dark shading here adopted, a close inspection is needed in order to determine whether the edge of the dark tint in a hilly area lies along a valley bottom or not; and to this extent the easy legibility of the maps is lessened. On the other hand, partly because of stronger shading, partly because the shadow of a lofty ridge extends out over the low land somewhat beyond the ridge base, the engineers' maps give a more immediate impression of dominant features, the recognition of which on the survey maps calls for closer attention.

As to the relative truthfulness of the two sets of maps: It is a general principle that every additional process introduced between an original manuscript map, as drawn by a skilful topographer in the field, and the final printed map, ready for distribution to the public, is likely to cause some slight loss of accuracy. Such loss is presumably minimized in photographic processes, but even there difficulties arise in connection with such matters as the variation of a sheet of paper with changes of humidity, as above alluded to. Manual processes are more difficult to control, and they here intervene in both the methods of producing shaded maps: in the hand-shading and in certain lithographic processes of the survey maps, and in the contour cutting as well as in certain later processes such as the building of the cardboard negative and the tooling of the first positive of the engineers' maps. But in both cases, errors are lessened by care; and as far as I have had opportunity of inspecting the work of making the maps, skilful care is exercised at every step of both methods.

The delicacy of the hand-shading on the survey maps is truly admirable; yet it can hardly have the authenticity of the shades as photographed from a model on the engineers' maps. Similarly, the accuracy of the jigsaw contour-cutting for the engineers' maps is remarkable; it is much increased by the use of a fine wire-like saw, with minute teeth on all sides, so that the cardboard may be fed against it in any direction; yet it would seem impossible that sharp angles such as are occasionally found in contour lines should be cut by this mechanical device. Again the tooling of the beeswax on the first cast model may fail to follow the cut contour lines here and there, especially in sharp reentrants. Yet as far as I have been able to learn, the final accuracy of the two sets of maps is closely comparable.

These new-style maps as produced by the Geological Survey have not been officially given any special designation. "Shaded maps" would seem to be a natural name for them, as they are darkened only on slopes turned away from the source of illumination. A possible confusion may be feared from the misuse of the term, shaded, for hachured maps also, but such confusion would be avoided if hachured maps were so called. The name "Shadow maps" has been proposed, but it seems unsuitable because the term, shadow, is properly used for the darkened part of a surface which is turned toward, not away from the source of illumination, but which fails to be illuminated by reason of some opaque object that stands in the way of the light. True, the engineers' maps include some shadows of precisely this kind, as has been pointed out above; but they are on the whole disadvantageous features, and as such do not serve well for a name. The engineers' maps have been officially called "Pictorial relief maps," but apart from the cumbersomeness of a trinomial term, the word "pictorial" seems unsuitable because, vivid as the maps are in the expression of relief, they are not at all pictorial in the ordinary sense of that word, which is commonly associated with perspective representation, and not with vertical projection.

The technical uses of these fine maps by the organizations which produce them are not here considered: it is their geographical value that should bring them into general notice. Fortunately, they are not secret official documents.

All the shaded maps thus far produced by the Survey and by the Engineer Corps may be purchased by the general public at ten cents each.

W. M. DAVIS

HARVARD UNIVERSITY

SCIENTIFIC EVENTS

FIRST CONFERENCE OF SPECIAL LIBRARIES AND INFORMATION BUREAUS

THE first Conference of Special Libraries and Information Bureaus was held from September 5 to 8, at High Leigh, Hoddesdon, Herts, England. Over eighty men and women interested in various ways in the collection and dissemination of informative matter attended.

The objects of the conference were outlined at the opening session by Dr. R. S. Hutton, director of the Non-Ferrous Metals Research Association, and J. G. Pearce, director of the Cast Iron Research Association. It has long been felt that many diverse agencies concerned with the treatment of information have

problems in common, and needed an opportunity to establish mutual cooperation and assistance, and to determine their relationship to the press, and to the great municipal and national libraries and other institutions.

Subsequently, Allan Gomme, librarian to H. M. Patent Office, London, B. M. Headicar, of the London School of Economics, and Dr. S. C. Bradford, of the Science Museum, South Kensington, addressed the conference on their respective libraries.

Group meetings on the scientific, industrial and economic libraries were addressed by W. M. Corse, of the National Research Council, Miss L. Stubbs and H. G. Lyall. The session on economic and statistical libraries indicated valuable developments which are taking place with regard to forecasting of trade tendencies.

An address by Lieutenant-Colonel J. M. Mitchell, secretary to the Carnegie Trustees, outlined the policy of the trustees with regard to special libraries, and L. Stanley Jast, chief librarian in Manchester, and Lieutenant-Colonel E. L. Johnson, director of the Cleveland Technical Institution, dealt with special libraries in relation to other libraries and institutions.

Among the details of methods and equipment, Dr. J. C. Withers, of the British Cotton Industry Research Association, presented a paper on abstracting, and H. Rottenburg, of Cambridge, on a guide to scientific and technical literature. Bibliographical aids to special libraries, such as "The subject index to periodicals" and "World list of scientific periodicals" were considered.

The important function of the press in collecting and distributing information was dealt with by F. H. Masters, editor of *The Electrician,* and V. C. Faulkner, editor of *The Foundry Trades Journal,* and at the concluding session, Dr. E. A. Baker, director of the school of librarianship, University College, considered the question of training men and women for work in special libraries.

The conference, which was highly successful, provided abundant evidence of the interest in this field of work, and in order to ensure continuity of interest, without forming another association, a standing committee of the conference was appointed with power to consider matters in the interests of those engaged in directing or operating special libraries, and to convene a further conference at some future date. This committee is representative of a wide range of institutions, and has already held its first meeting.

The most striking feature of the conference was the keenness displayed by a large number of highly diversified interests, including scientific, technical, industrial, wholesale and retail commerce, railways, political, agricultural, governmental, universities, press, medical, sociological and banking. This diversity served merely to emphasize the common interest of all these agencies in receiving, treating and distributing documentary material.

A. F. RIDLEY, *Librarian*
BRITISH NON-FERROUS METALS
RESEARCH ASSOCIATION,
BIRMINGHAM, ENGLAND

INVESTIGATION OF REINFORCEMENT IN CONCRETE ROADS BY THE NATIONAL RESEARCH COUNCIL

THE details of plan and procedure to be followed in the investigation of the economic value of reinforcement in concrete roads, being undertaken by the Highway Research Board of the National Research Council, are now completed and field examinations are about to commence. Director Chas. M. Upham reports that the various state highway commissions will actively cooperate with the board in conducting this investigation. Except in cases of actual failure, inspections will concern principally pavements having had at least five years of service, a great number of which are located in states such as New Jersey, Ohio, New York, Pennsylvania, Delaware, Wayne County, Michigan; Milwaukee County, Wisconsin; Iowa, Illinois and California.

In this intensive study an effort will be made to determine from a survey of existing roads the influence of steel reinforcement on the resistance of the slab to traffic, subgrade and climatic conditions; the conditions under which steel reinforcement is especially beneficial to concrete slabs; the effect of slab design on the efficiency of reinforcement, and, finally, the relative cost of plain and of reinforced concrete roads, considering the initial investment, and the annual maintenance and renewal charges.

The procedure will consist of a personal examination of a sufficient number of existing road surfaces to cover different slabs, traffic and climatic conditions. It is proposed to supplement the examination by photographs, sketches, soil determinations and other available data. In each case, attention will be given to a study of the subgrade to determine its general characteristics and properties as well as the existing drainage conditions. In the case of the slab, a study will be made of original data to determine the materials and proportions that entered into the concrete, the method of construction that was followed and the particular cross section used. Careful note will be made of joints, cracks, replacement areas and general surface conditions. The influencing factors of grade, alignment, location and maintenance will be noted, and the matter of age, traffic and climatic conditions will be given careful consideration. In the case of the reinforcement, a study will be made of the rela-

tive amounts of longitudinal and transverse steel, the method of treating reinforcement before placing, as well as its position in the slab. The form of the reinforcement will receive consideration to determine the relative values of fabric, rods and other types in use. An effort will be made to determine the comparative value of hard steel and of mild steel for reinforcement, and the influence of continuous and non-continuous reinforcement. Wherever possible, the present condition of the reinforcement will be noted for breaks, rust and other features of interest. Wherever obtainable, cost data will be secured covering the original as well as the maintenance investment.

The preliminary work of assembling data now available will soon be completed, at which time the field inspections will begin. The itinerary will be made out after further study, but it is proposed to pursue the investigation in the northern sections until cold weather, when attention will be turned to the southern locations. It is expected that a progress report will be ready for the annual meeting of the Advisory Board on Highway Research to be held at the building of the National Research Council on December 4 and 5.

INSTITUTE OF RESEARCH AT LEHIGH UNIVERSITY

ANNOUNCEMENT has been made of the establishment of the Lehigh Institute of Research by the administration of Lehigh University. In announcing the purposes of the institute, the Board of Trustees, of which E. G. Grace, president of the Bethlehem Steel Corporation, is president, stated that the object is

> to encourage and promote scientific research and scholarly achievement in every division of learning represented in the organization of the university; and in recognition of the need for further and more exact knowledge in science and in the applications of science to the affairs of modern life. It is believed that this organization will be helpful in stimulating interest in liberal and professional education; and that it will prove to be of value to the professions and industries of the nation.

The Lehigh Institute of Research will afford training in research methods to the following classes of individuals: the members of the teaching staff of the university; the members of the scientific staff of the institute, including research fellows, research assistants and research professors appointed by the university and paid by it from its own funds or from funds for the purpose supplied by an individual, a firm or a corporation; graduate students in the university; special investigators temporarily employed for work on a particular investigation. The founding of research fellowships or research professorships in the Lehigh Institute of Research is a means for encouraging research and for assisting promising men to secure advanced training in the methods of research. The first fellowship of this kind has been founded by the New Jersey Zinc Company, and is known as the New Jersey Zinc Company's Research Fellowship in Science and Technology.

To preserve the records of its investigations and to render them available to every one interested, the Lehigh Institute of Research proposes to publish and distribute from time to time bulletins presenting the results of investigations conducted by or under its direction, and to issue other material which may be helpful to the various interests which it seeks to serve. Under certain conditions, and with the approval of the executive board, reports of such investigations may be presented before professional or other learned societies and published by them.

The executive board of the Lehigh Institute of Research is composed of the following: Dr. Charles Russ Richards, president of the university; Harry Maas Ullmann, professor of chemistry; Ralph Justin Fogg, professor of civil engineering; William Esty, professor of electrical engineering; Lawrence Boylston Chapman, professor of marine engineering; Fred Viall Larkin, professor of mechanical engineering; Dr. Bradley Stoughton, professor of metallurgy; Howard Eckfeldt, professor of mining engineering; Barry MacNutt, professor of physics; Dr. Benjamin LeRoy Miller, professor of geology; Dr. Robert William Hall, professor of biology; Dr. Neil Carothers, professor of economics; Dr. Lawrence Henry Gipson, professor of history and government.

SCIENTIFIC NOTES AND NEWS

THE Rensselaer Polytechnic Institute held special convocations on the occasion of the celebration of the centenary of its foundation, on October 3 and 4. On the first day the degree of doctor of engineering was conferred upon President Sir Charles Langbridge Morgan, of the Institute of Civil Engineers of Great Britain; President Henri Abraham, of the Society of Electrical Engineers of France; President Luigi Luiggi, of the Society of Civil Engineers of Italy, and President Arthur Surveyer, of the Engineering Institute of Canada. On the second day the degree of doctor of philosophy was conferred upon President James R. Angell, of Yale University; President Edward A. Birge, of the University of Wisconsin; President Samuel W. Stratton, of the Massachusetts Institute of Technology, and President Livingston Farrand, of Cornell University; the degree of doctor of science on Albert A. Michelson, president of the National Academy of Sciences, and the degree of doctor of engineering on Carl E. Grunsky, president of the Amer-

ican Society of Civil Engineers; Frederick R. Low, president of the American Society of Mechanical Engineers; William Kelly, president of the American Institute of Mining and Metallurgical Engineers, and Farley Osgood, president of the American Institute of Electrical Engineers.

THE celebration of the connection with the department of chemistry for fifty years of Dr. Edward S. Hart takes place at Lafayette College from October 16 to 18. The first part of the celebration will be in connection with the college Founders' Day exercises commemorating the centennial of the college on the morning of October 16. The remainder of the program will be under the auspices of the Lehigh Valley, New York, Philadelphia, Wilmington and the south Jersey sections of the American Chemical Society.

DR. HARVEY W. WILEY will be the guest of honor at a dinner to be given on October 20 in connection with the meeting of agricultural chemists in Washington. On October 18 Dr. Wiley will celebrate the eightieth anniversary of his birth.

THE French government has conferred the Cross of Chevalier of the Legion of Honor on Dr. Frederick G. Novy, professor of bacteriology and director of the hygienic laboratory of the University of Michigan.

FRANCIS F. LUCAS, of the Western Electric Company, was awarded the Howe gold medal at the annual dinner of the American Society for Steel Treating, for "having written during the past year the best paper on the scientific treating of steel."

PROFESSOR CHARLES LANE POOR, of Columbia University, has been appointed chairman of a committee from the New York Yacht Club to attend the International Conference on Yacht Measurement, which meets in London on October 16.

DR. S. P. L. SÖRENSEN, of the Carlsberg Laboratories, Copenhagen, was recently elected an honorary member of the American Chemical Society.

SIR CHARLES A. PARSONS, chairman of the Parsons Marine Turbine Co., of London, and Senator Luigi Luiggi, president of the Society of Italian Engineers, were given a luncheon at the Engineers Club of New York, on September 26.

DR. NICHOLAS KOPELOFF has returned to the Psychiatric Institute, Ward's Island, New York City, to resume his work as bacteriologist, after a year spent at the Pasteur Institute in Paris and other European institutions.

DR. CLYDE H. BAILEY, professor of agricultural biochemistry at the University of Minnesota, and director of the Minnesota State Experimental Flour Mill, has been granted a year's leave of absence from the university to become director of the technical bureau, Biscuit and Cracker Manufacturers Association, with headquarters in Chicago.

DR. WADE WRIGHT, instructor of industrial medicine at the Medical School of Harvard University, has resigned to take up work with the Metropolitan Life Insurance Company, New York.

DR. FREDERICK C. NARR, formerly of Pittsburgh, has been appointed director of the pathologic laboratories of the Research Hospital at Kansas City.

HENRY G. BERGER, formerly a member of the research staff of the Pittsburgh Experiment Station of the U. S. Bureau of Mines, has been appointed research chemist in the insulation division of the Armstrong Cork Co., Gloucester, N. J.

THE trustees of Radcliffe Observatory, Oxford, have appointed Harold Knox-Shaw, of Trinity College, Cambridge, formerly head of the observatory at Helwan, Egypt, to be Radcliffe Observer in succession to the late Dr. A. Rambaut.

PROFESSOR H. KOPFF, of the Heidelberg Observatory, has been appointed professor of theoretical astronomy in the University of Berlin and director of the Astronomischen Recheninstituts.

PROFESSOR F. PASCHEN, of the University of Tübingen, has accepted the directorship of the Reichsanstalt and will accordingly not be able to lecture at the University of Michigan this semester, as previously announced. A cable to this effect was received on September 22.

DR. JOSEPH F. ROCK, botanical explorer for the Arnold Arboretum of Harvard University, who recently returned from an expedition into the interior of China, is leaving the United States to continue his explorations in these regions. Dr. Rock expects to be away for three years.

A LUNCHEON in honor of Vilhjalmur Stefanssen, the explorer, who has returned to this country after several months in Australia, was given recently in New York. Mr. Stefansson opened his lecture tour in San Francisco on October 6, and next year will again leave for Australia to resume his explorations. He will also go to South Africa to study the deserts there.

ROALD AMUNDSEN, the Norwegian explorer, has sailed for the United States, where he is to make a lecture tour.

DR. THORVALD MADSEN, director of the Danish Serotherapeutic Institute, Copenhagen, will give the Cutter lecture on preventive medicine at the Harvard Medical School on October 14. The subject of the

lecture will be "Whooping cough: its bacteriology, diagnosis, prevention and treatment."

PROFESSOR HENRI ABRAHAM, director of the physics laboratory at the University of Paris, gave a public lecture on the evening of September 25 at the Carnegie Institute of Technology in Pittsburgh on the subject of "Measurement of time." An audience of 350, including a large number of scientific men, attended the lecture.

THE California Academy of Sciences announces a special course of four lectures on "The ways of nature" to be given by Dr. David Starr Jordan, chancellor of Stanford University, in the Auditorium of the Academy's Museum in Golden Gate Park, at three o'clock on Sunday afternoons beginning on October 8.

A MEMORIAL to Lord Lister was unveiled on September 20 in Kelvingrove Park, Glasgow, Scotland. It is a seated figure in bronze by the sculptor George Henry Paulin.

AT the conclusion of the opening ceremony of the sixty-ninth annual exhibition of the Royal Photographic Society held at the rooms of the society in London, a memorial portrait in bronze of Henry Fox Talbot was unveiled in the library. Mr. Talbot was one of the pioneers of photography, and was the inventor of a process by which positives are obtained from negatives.

MISS CLARA LUDLOW, of the Army Medical Museum, known for her work on disease-bearing mosquitoes, died on September 28, aged seventy years.

DR. SIDNEY MARTIN, F.R.S., physician to University College Hospital, London, and distinguished for researches in chemical physiology and pathology, died on September 22, aged sixty-four years.

DR. FRANZ DOFLEIN, emeritus professor of zoology and comparative anatomy in the University of Breslau, died on August 26, at the age of fifty-one years.

ACCORDING to the *Journal of Terrestrial Magnetism* there have been held recently in Russia various meetings and conferences relating to the furtherance of geophysical work in Russian countries. Professor P. Lasareff, of the University of Moscow, has been appointed president of the Magnetic Commission, which has for its purpose the continuation of the magnetic survey of Russia and its dependencies.

THE New England Intercollegiate Geological Excursion will be held in the vicinity of Brown University, Providence, on October 10 and 11. The carboniferous series including the coal deposits will be studied, also the metamorphic rocks, the shore lines and the glacial geology.

ACCORDING to the *Journal of the American Medical Association* the fifty-third annual meeting of the American Public Health Association will be held in Detroit, from October 20 to 23, under the presidency of Dr. William H. Park, of New York. Dr. T. Madsen, chairman of the Health Section of the League of Nations, will address the first general session Monday evening, October 20. The second general session, on October 22, will be presided over by the Forum Committee of the association; the third, on Wednesday, will be a symposium on "Values in public health." Dr. George F. Dick, of Chicago, among others, will address the public health administration section. There are nine sections in the association, each of which will be addressed by a number of prominent men. Dr. R. M. Olin, state health commissioner of Michigan, is chairman of the local committee arranging for the meeting. The American Society of Civil Engineers will hold a meeting directly following the meeting of the American Public Health Association and a joint session between the sanitary engineering divisions of both organizations has been arranged.

THE fall meeting of the New England Federation of Natural History Societies was convened at Taunton, Mass., on September 26–27, the federation being the guest of the Bristol County Academy of Sciences. Sessions were held at the Taunton Public Library with an evening meeting at a neighboring church. The speaker of the evening was Mr. A. C. Bent, of Taunton, who outlined, with lantern illustrations, a recent exploring trip across Arizona, the purpose of which was the study of birds and plants. At the business meeting on September 27, Norman Easton, president of the Fall River Natural History Society, presented some of the problems confronting small societies in the less important cities. Specialization, he said, makes it difficult for a general society to maintain its interests, while the automobile has had its effects on outings. It was shown by others that, while the matter is not as yet definitely systematized, the automobile may be very useful in carrying a party to the field for collecting or observation. At present this needs much planning, but in general, according to the experience of the Rhode Island Field Naturalists Club, it may be done even with large parties, its recent outing to the bird reservation at Kingston, R. I., some forty miles from Providence, being a case in point. Saturday morning, September 27, was devoted to the gathering of mushrooms, which were exhibited during the afternoon. In the afternoon James H. Emerton, of Boston, read the roll-call of societies, some fifteen of which were represented. John Ritchie, of Malden, presided.

THE first international conference of research men

in the sugar cane industry was brought together at the Pan-Pacific Food Conservation Conference at Honolulu, July 28 to August 14, under the auspices of the Pan-Pacific Union. Representatives at the sugar conference were present from Australia, Fiji, Formosa, Japan, Philippine Islands, India, Java, Chile, Mexico, Porto Rico, Cuba, the continental United States and the Hawaiian Islands. The meeting was considered so fruitful by those in attendance that a permanent organization to be called the International Society of Sugar Cane Technologists has been perfected. The purpose of the society as outlined in the constitution is as follows: "An organization to promote by means of triennial conventions the discussion of problems connected with sugar production in both field and factory." Officers elected for the present triennial term were Hamilton P. Agee, of Hawaii, as general chairman and M. S. Barnett, of Australia, as general secretary; H. Atherton Lee was appointed assistant secretary. The next meeting of the society will be held in Havana, Cuba, in February, 1927.

WE learn from *Nature* that the first conference of the Pathological and Bacteriological Laboratory Assistants' Association was held from September 1 to 5, in the department of pathology of the University of Edinburgh. The attendance was good, there being members present from all parts of Great Britain and also from Africa. The local organization was in the hands of a committee appointed by the Scottish division of the association. Lectures and demonstrations in laboratory technique were held, an exhibition of laboratory work and apparatus was on view and places of interest in and around Edinburgh were visited. Members of the Scottish division of the association were responsible for the exhibition, while the London division showed objects of tropical interest and demonstrated specimens illustrating the life history of parasites and their insect hosts. At the dinner on September 5, the president, Professor A. E. Boycott, made the presentation of the first Woodhead medal to Albert Norman together with an address. This medal has been established by means of funds collected among members of the association in memory of the late Sir German Sims Woodhead. In all, £141 has now been received and the subscription list is soon to be closed.

A GENERAL discussion on the physical chemistry of igneous rock formation is to be held in the rooms of the Geological Society of England, London, on October 22. The meeting is being organized under the joint auspices of the Faraday Society, the Geological Society and the Mineralogical Society. A general introduction will be contributed by Dr. J. S. Flett, and papers are expected from Professor C. H. Desch, Dr. J. W. Evans, Professor J. W. Gregory, A. F. Hallimond, Professor Paul Niggli, Dr. A. Richardson, Dr. A. Scott, G. W. Tyrrell and Dr. W. E. S. Turner.

A LARGE collection of natural history material and Indian artifacts has been given to the Oregon Agricultural College, by the heirs of the collector, the late Dr. J. L. Hill.

THE California Academy of Sciences has received by the will of the late Henry M. Holbrook a collection of Lepidoptera of several thousand specimens, and the sum of $2,000 in cash with which to meet the cost of installation.

THE corner-stones of the Todd Memorial Clinic and the Cancer Institute at the university hospitals, University of Minnesota, were laid on October 1.

DEAN E. D. MERRILL, of the University of California College of Agriculture, has recommended the transfer of the Division of Citriculture and Subtropical Horticulture from Berkeley to the Citrus Experimental Station at Riverside, California.

THE Council of the Zoological Society of London has instituted an Aquarium Research Fellowship of the annual value of £350, tenable for one year, but with the expectation of reappointment for two further years if satisfactory progress is being made.

THE formal opening of the Ramsay Laboratory of Chemical Engineering at University College, London, instituted in 1923 as part of the memorial to the late Sir William Ramsay, will take place in November. A full course of study in chemical engineering will be provided in the laboratory in the coming session, leading to the degrees of M.Sc. or Ph.D. in chemical engineering. The course is designed to meet the demands of the manufacturing industries for men trained in the application of scientific methods to the design and operation of industrial chemical processes and plant. Special facilities are provided for research.

UNIVERSITY AND EDUCATIONAL NOTES

ONE million dollars has been pledged to the Hampton Normal and Agricultural Institute, Virginia, and the Tuskegee Normal and Industrial Institute, Alabama, by the Rockefeller General Education Board on condition that the trustees of the two schools raise an equal amount.

CATHOLIC UNIVERSITY, Washington, has received a gift of $750,000 from John K. Mullen, of Denver, which is to be used for a library building.

THE new Goessmann Laboratory of Chemistry at the Massachusetts Agricultural College, erected at a

cost of $300,000 and now almost completed, was dedicated on October 3. The laboratory is named for the first professor of chemistry at the college.

DR. HENRY PAGE, dean of the school of medicine at the University of Cincinnati, has resigned.

AT Harvard University Dr. Frank H. Lahey, professor of clinical surgery, and Dr. Roger I. Lee, Henry K. Oliver professor of hygiene, have resigned.

DR. LEE PAUL SIEG, professor of physics at the State University of Iowa, has been appointed head of the department of physics at the University of Pittsburgh, in the place of Dr. Jay H. Clo, who has resigned to accept a research position with the J. E. Shrader Company, of New York. Dr. Richard Hamer, of the University of Wisconsin, and Dr. W. N. St. Peter, of the University of Michigan, have been appointed assistant professors in the same department.

DR. G. A. TALBERT, formerly associate professor of physiology at the University of Nebraska Medical School, has become professor of physiology at the University of North Dakota.

DR. CARL OTTO, of the University of Cincinnati, has been appointed assistant professor of chemistry at the University of Maine.

DR. H. N. CALDERWOOD, JR., of the United States Forest Products Laboratory in Madison, has been appointed assistant professor of chemistry at the University of Wisconsin.

DR. M. J. ZIGLER has been elected assistant professor of psychology at Wellesley College.

ASSISTANT PROFESSOR W. L. G. WILLIAMS, of Cornell University, has been appointed assistant professor of mathematics at McGill University.

DR. ARCHIBALD YOUNG, professor of surgery and dean of the Anderson College of Medicine, Glasgow, has been appointed Regius professor of surgery in the University of Glasgow, in succession to the late Sir William Macewen.

DR. MAX V. GRUBER, professor of hygiene and bacteriology at the University of Munich, has resigned, and Professor Paul Uhlenhuth, of the University of Freiburg, has been appointed to take his place.

DISCUSSION AND CORRESPONDENCE

AN UNPUBLISHED METRICAL EPIGRAM BY JAMES RUSSELL LOWELL

DURING the "renaissance of New England," Jeffries Wyman, Harvard's gifted anatomist, enjoyed the friendship of famous *literati*. Among his papers there is a battered photograph of bones, on which he had written—"From Prof. J. R. Lowell." Professor Lowell had doubtless felt able to part with it, but first inscribed on it elegiac couplets in German script, suggested by the picture, and of interest to its recipient. The photograph was issued by Hermann Kron, of Dresden, and shows, against a draped background, a well-posed skeleton of a powerful lion; a human skull, on the floor beneath the lion, marks the proportions of a puny race.

These are the verses which Lowell wrote:

Mäste dein Vieh in geeigneter Art mit erleuchtendem Phosphor—
Weiser als Moleschott wirds, triffst du das richtige Mass.
Giebst du zu wenig, so folget der Fluch entsetzlicher Dummheit,
Aber ein Gran zu viel—! Siehe dies Löwenscelett!!![1]

The reference is to the celebrated physiological chemist, Jacob Moleschott (1822–1893), who concluded the chapter on "peas, beans and lentils" in his *"Lehre der Nahrungsmittel—Für das Volk"* with some luckless and immortal comments. The brain can not exist without its phosphorus-containing fat, he said, which may be built up from the phosphorus in meat, bread and peas, or obtained preformed in fish and eggs. He rambles on:

So it is jokingly remarked that a wise man has much phosphorus in his brain. No scientist would mean it seriously. For the composition of an organ suffers as much from excess as from deficiency . . . and therefore great thinkers avoid superfluous phosphorus. Yet it is true:—without phosphorus, no thought.[2]

William James disposes of the matter in his "Principles of Psychology,"[3] and introduces Agassiz, the friend of Wyman and Lowell, in this passage:

"Ohne Phosphor, kein Gedanke" was a noted war-cry of the "materialists" during the excitement on that subject which filled Germany in the '60s. The brain, like every other organ of the body, contains phosphorus, and a score of other chemicals besides. Why the phosphorus should be picked out as its essence, no one knows. It would be equally true to say "Ohne Wasser kein Gedanke," or "Ohne Kochsalz kein Gedanke;" for thought would stop as quickly if the brain should dry up or lose its NaCl as if it lost its phosphorus. In America the

[1] They may be freely translated:
Fodder your beasts in a suitable way with light-giving Phosphorus—
Wiser than Moleschott, they,—granted the dose be correct.
Feed them too little, you blight them, and make of them stupidest asses;
Give but a grain too much—! See them all burnt to a bone!!!

[2] Zweite Auflage. Erlangen, 1853, S. 120.

[3] N. Y., 1890, Vol. 1, p. 101.

phosphorus-delusion has twined itself round a saying quoted (rightly or wrongly) from Professor L. Agassiz, to the effect that fishermen are more intelligent than farmers because they eat so much fish, which contains so much phosphorus. All the facts may be doubted.

Mark Twain, in 1875, was perhaps more humorous than he realized, when he placed whales with fishes in this "Answer to Correspondents":

YOUNG AUTHOR.—Yes, Agassiz *does* recommend authors to eat fish, because the phosphorus in it makes brains. So far you are correct. But I can not help you to a decision about the amount you need to eat—at least, not with certainty. If the specimen composition you send is about your fair usual average, I should judge that perhaps a couple of whales would be all you would want for the present. Not the largest kind, but simply good, middling-sized whales.

"American humor is nearly as ephemeral as the flowers that bloom in the spring," writes Aldrich. "Each generation has its own crop, and that of 1860, were it to break into blossom at the present moment, would probably be left to fade upon the stem." But some, perhaps, would regret to lose what has here been recorded of Lowell. As to Mark Twain, he "is not to be classed with the fragile plants."

FREDERIC T. LEWIS
HARVARD MEDICAL SCHOOL

AS STUDENTS UNDERSTAND IT

IN SCIENCE of August 29, Professor Ellison A. Smyth, Jr., gives an amusing series of student blunders and carelessness in relation to facts of biology. These plainly show that the persons in question knew nothing and cared less for the work required of them.

But does it not illustrate still more plainly "the dry rot of academic biology" and the misuse of the lecture system?

In his admirable autobiography, Professor Pupin criticizes the University of Cambridge for giving him "information" when he needed "contact." Information is what the usual "lecture courses" give, and what the conventional examination asks for, from which the average student gains nothing. Such information is, in general, mechanically given, imperfectly understood by the student, and soon dismissed from his mind.

The results of contact may be permanent. Only by direct relation to things as they are can any healthy teaching in biological subjects be attained. This was clearly shown by word and deed by Agassiz, more than fifty years ago. In our day, the impulse he gave is unfortunately dying out. It is not now the fashion, even for the teacher, to know anything in detail and with exactness. Some zoologists have never looked an animal in the face. A university should train men to observe accurately, to think for themselves and with enthusiasm. To give information is a relatively minor matter. The Sunday newspaper attends to this.

There are two main justifications for college lectures on science. One is to bring together in unified relation facts developed in the laboratory. The other is to develop enthusiasm, "to give inspiration," as the phrase is. To make such lectures worth while the teacher himself must have a degree of inspiration, with skill in making his words connect with the ideas already possessed by his audience.

The student who has handled a reptile or two will not write: "Reptiles have two or more pairs of limbs, such as the locust and others."

Nor will one who knows a bacillus at sight say: "Bacteria are used when vaccinating a person for disease; again they are used in spraying plants."

The fault in the matter of "senterpedes" and "bile ducks" does not lie with the teaching of spelling in the lower schools, but in the use in college of words which convey no actual meaning. Let us have contact as a basis for information. "It is not enough to tell a student that a magnet attracts iron, he must himself feel it pull."

DAVID STARR JORDAN
STANFORD UNIVERSITY

MAY I add to those choice "howlers" of Mr. Smyth's in SCIENCE of August 29 these two samples.

Mine, however, are not by any bewildered child under stress of examination, but from a printed sermon, written with "The Outlines of Science" open under the preacher's nose, by a doctor of divinity, a graduate of a New England seminary, who has been vice-president of his denominational educational society and trustee of four colleges.

The North Star . . . is said to be moving away from us with incredible rapidity, and yet is so far distant that it has seemed to change its relative position but a very little in a thousand years.

Another valuable feature of the spectroscope is its ability to measure the speed of light, even when the light is coming straight toward the instrument. The speed being determined, the distance of the star from which the rays come can be reckoned.

E. T. BREWSTER
ANDOVER, MASS.

LATIN AS AN INTERNATIONAL LANGUAGE

In reference to the letter of Professor Roland G. Kent about the use of Latin as an international auxiliary language, published in SCIENCE for June 20, 1924, pp. 554–555, may the attention of your readers be called again (see SCIENCE for April 11, 1919, Vol.

49, pp. 356–357) to "Interlingua" or "Latino sine flexione" proposed by Professor Peano of Turin University, president of the "Academia pro Interlingua"? Many believe that Interlingua has all advantages of Latin without its drawbacks. A quotation from one of the circulars of the "Academia" follows:

INTERLINGUA sive LATINO SINE FLEXIONE

Hodie quasi omni auctore scribe in proprio lingua nationale. Multitudine de linguas in labores de interesse commune ad toto humanitate constitue magno obstaculo ad progressu. Ex patiente studio de intelinguista resulta evidente quod linguas de Europa habe numeroso vocabulo commune. Vocabulario internationale es in quasi totalitate latino, graeco incluso, et es documento de historia de nostro civilizatione. Grammatica pote es reducto ad pauco aut nihil. Plure anno de studio non suffice pro posside latino aut alio lingua nationale, pauco hora suffice pro lingua internationale. Interlingua es intelligibile ad primo viso aut quasi.

Some pamphlets on the question are available for distribution to any of your readers interested in the subject.

A. FANTI

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WASHINGTON, D. C.

PALEOLITHIC AND NEOLITHIC OBJECTS FROM EUROPE

THE undersigned has been granted a sabbatical year and sailed for Europe on September 13. He expects to visit prehistoric and neolithic sites in France, Belgium, England and Italy. During his travels he will secure from archeologists, museums or collectors type specimens illustrating the life of primitive man in these various countries. Two or three museums have asked him to obtain for them small exhibits. Readers of SCIENCE or museum curators who may desire European objects will please communicate with him at the below address and his secretary will forward the communication.

WARREN K. MOOREHEAD

DEPARTMENT OF ARCHEOLOGY,
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ANDOVER, MASS.

SCIENTIFIC BOOKS

La Géologie Sismologique, Les Tremblements de Terre, Avec une préface de M. Pierre Termier, Membre de l'Institut. By COMTE FERNAND DE MONTESSUS DE BALLORE. Colin, Paris, 1924, pp. xiv and 488, 14 pls. and 114 figs.

THE posthumous appearance of the Count de Montessus's "La Géologie Sismologique" marks the completion of the seismologic trilogy, the first volume of which, "Seismic Geography," first saw the light in 1906 and was quickly followed by "Seismic Science" in 1907. With singleness of purpose the Count has pursued his studies throughout more than a score of years and was busy reading the proofs of this completing volume when he was stricken with his fatal illness. Undeterred, he continued to labor upon these proof sheets with his accustomed ardor until the very day of his death, nearly three weeks later.

Together these three massive volumes, well organized and written in a clear incisive style, comprise what is now known of the science of seismology. They stand alone in their field as a comprehensive work of generalization, and are likely long to remain so. When nearly a half century ago the Count was a resident of San Salvador on a military mission and first turned his attention to the earthquakes which so frequently racked that country, it could hardly be said that a science of seismology existed. The misguided centrum theory of earthquakes, due to Robert Mallet and dating from 1862, explained earthquakes as occasioned by an explosion of gases within a subterranean chamber (centrum), and the brilliant system of the Dutch physicist, Huyghens, had been cleverly made use of to follow the vibrations sent out from the supposed centrum. By many, however, earthquakes were still supposed to have their cause either in the atmosphere or in the changes of the moon. The part which the Count's own studies have had in dispelling all these erroneous notions is a dominating one.

In his "Seismic Geography" de Montessus showed on the basis of a comprehensive statistical study of the earthquakes of history, that about 95 per cent. of all known earthquakes have occurred within two great-circle belts, one circum-Pacific and the other intersecting the first at an angle of about 67 degrees and taking its course through Malaysia, the Mediterranean and the Caribbean. These zones de Montessus recognized as the Mesozoic geosynclines and as the belts of growing mountains of Tertiary and later periods. Such definite localization of earthquakes probably gave somewhat too great prominence to these belts and overemphasized a supposed immunity of the regions outside. Heavy earthquakes have indeed occurred in a few instances in the outside areas, such for example, as the great earthquake of the St. Lawrence Valley, February 5, 1663, the New Madrid earthquake of 1811 within the Lower Mississippi Valley, and the Charleston earthquake of 1886.

In his concluding volume, "Seismic Geology," the Count sets up a modified classification of earthquakes, apparently so as to include these neglected regions which have greater stability but lack entire immunity. He distinguishes two main classes: (I) glyptogenic

or geologic earthquakes, and (II) external dynamics earthquakes, which include volcanic and landslide earthquakes, both relatively unimportant. Under (I) are to be found practically all the great earthquakes of history, and these de Montessus subdivides into (1) epeirogenic, (2) tectonic or orogenic earthquakes and (3) epeirogenic and tectonic earthquakes.

The reviewer believes that neither in its plan nor in the allocation of individual earthquakes is the Count's classification satisfactory. The fact that the earthquake of Casamicciola (Ischia) in 1883 was centered on the flanks of the volcano of Epomeo does not show that it was volcanic in origin, for Cassamicciola is well known to lie at the intersection of dislocation lines. It is also difficult to understand why the earthquake of Assam in 1897 or various Chilian earthquakes should be placed in the epeirogenic class, since they occurred either within or close to the zones of mountain growth. The reviewer believes, moreover, that it will in most cases be found impossible to determine in how far epeirogenic movements in the sense employed by de Montessus may or may not be combined with orogenic ones; and that it would have been both simpler and more nearly correct to make of the glyptogenic (better, tectonic) class two subdivisions only, one called orogenic and connected with mountain growth, and the other epeirogenic and not so connected but related to block faulting *per se*.

The Count's isolation, because of his residence in Chili during the last eighteen years of his life when he was preparing the "Seismic Geology," imposed a handicap which was to a large extent overcome by his wide correspondence, by his large personal library and by his intimate familiarity with many European languages.

WILLIAM HERBERT HOBBS
UNIVERSITY OF MICHIGAN

LABORATORY APPARATUS AND METHODS

A CULTURE TUBE FOR USE WITH COLLODION SACS

IN the course of recent studies of bacteria, the associated growth of gas formers and non-gas formers was under observation. It was desirable to cultivate the organisms in the same medium separated by a collodion membrane. After several tests, the method of preparing permeable membranes, as described by Gates,[1] was followed. This method, if carefully followed, gives excellent results.

For anaerobic non-gas formers the V-shaped glass tubes as designed by Gates[2] were used. This apparatus, however, is unsuitable for cultures of gas formers. To meet the conditions of these gas producers it was found desirable to develop an apparatus as shown in Fig. I.

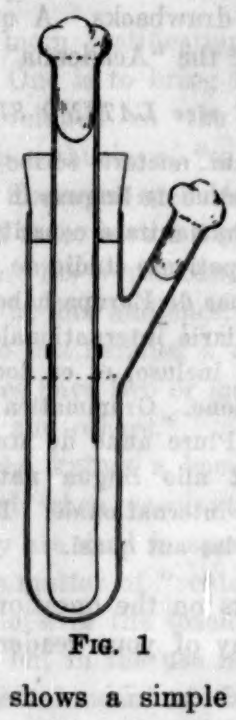

FIG. 1

The illustration shows a simple arrangement for the culture of bacteria and other micro-organisms on opposite sides of a collodion sac. These tubes have also been found convenient in experiments where a membrane is interposed between solid bodies and bacterial cultures as in the Noguchi method. They are convenient to handle and may be inserted into the common type of test tube stand. The side arm of the tube affords an easy means of inoculating culture media or withdrawing solutions from outside the sac, while material inside the sac may be reached through the glass supporting tube to which the sac is attached. These tubes may be used with either a rubber stopper or a cotton plug carefully fitted to the supporting tube and pressed into the larger tube.

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UNIVERSITY OF WISCONSIN,
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CADAVERA WITH FLEXIBLE JOINTS

THE rigidity of the joints of the cadaver as ordinarily prepared impedes the progress of the dissection. In the study of muscle action it is especially desirable to have a flexible specimen. In such a specimen the orifices of the body may be approached naturally. Any method resulting in flexibility should be of ready application and preferably should call for no great alteration in the preserving fluids used.

For the past thirty months the following simple method has given us satisfactory results. Upon bringing the cadaver into the embalming room the joints are manipulated so as to secure free and complete mobility. By steady traction each joint is once com-

[1] Gates, F. L., *Jour. Exp. Med.*, XXXIII, 25 (1921).
[2] Gates, F. L., *Jour. Exp. Med.*, XXXV, 635 (1922).

pletely carried through its characteristic movements and counter movements. This produces the maximum lengthening of the muscles acting upon the joint. This lengthening is permanent.

It is now only necessary to use a fluid that will not make the joint capsule rigid. This means that liquor formaldehyde (U. S. P.) can not be used, for as little as 500 cc per cadaver produces rigidity. The fluid we use in this laboratory, like the majority of those fluids used in this country, consists of varying mixtures of phenol (pure crystalline), alcohol and glycerine.

Rigor mortis when present ordinarily does not interfere with the mobilization of the joints. Very muscular cadavera may be conveniently left at room temperature over night so that the rigor may subside. The entire manipulating of the body, including the mobilization of the vertebral column and the temporomandibular joint, does not require more than ten minutes. Torn muscles have not been found in the dissection of over one hundred cadavera prepared by this method. It is of course possible to obtain similar results by using an arsenic fluid without manipulation; however, arsenic fluids are at present not in favor as preserving media for routine class material.

O. V. BATSON

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SPECIAL ARTICLES

THE SURFACE EQUILIBRIUM OF COLLOIDAL SOLUTIONS. II

ANTAGONISTIC ACTION OF COLLOIDS

WHEN a trace of powdered sodium oleate is added to pure water or to a salt solution contained in a watch-glass, the surface tension decreases instantaneously and becomes very small. If the amount of sodium oleate added is smaller than (1/1,000), the drop will continue for over one hour until a certain minimum value is attained. This value will then remain practically constant.[1] But when the same amount of sodium oleate is added to the same watch-glass containing some other colloid in solution, instead of pure water or saline, the surface tension, after reaching instantaneously its bottom value, starts up immediately and in a few minutes, according to the concentrations, tends towards its original value or even reaches it. Of course, if the amount of sodium oleate (or any other strongly surface active colloid, such as sodium glycocholate) is too large, the final value will be smaller than the original value of the surface tension of the solution. The same thing will happen if the amount of the second colloid (antagonistic) is too small. Table I shows the results of one experiment.[2]

TABLE I

RISE OF SURFACE TENSION OF SERUM IN FUNCTION OF TIME AFTER A DROP DUE TO THE ADDITION OF SODIUM OLEATE

Pure Dog Serum, No. 1
Temperature 22° C.

About 1/10,000 in weight of powdered sodium oleate was used.

Time	Surface tension dynes
Before addition of sodium oleate	57.5
After addition of sodium oleate	39.0
After 15 seconds	44.0
After 30 seconds	48.0
After 1 min.	51.0
After 1.5 mins.	52.5
After 2 "	53.5
After 3 "	55.0
After 4 "	56.8
After 5 "	57.3
After 6 "	57.6
After 9 "	58.0
After 20 "	57.6

After having dropped from 57.5 dynes to 39.0 dynes (18.5 dynes drop) instantaneously, it comes back to 57.5 in less than 6 minutes. When the phenomenon is plotted in function of the time, it gives a very smooth logarithmic curve. Of course, in order to study this phenomenon, it is clear that the Tensiometer[3] previously described must be used, since measurements of the surface tension of the *same* layer of liquid are required at least every minute.

As far as we could see, this phenomenon is general for all colloids studied. In other words, the less surface-active colloid will tend to adsorb the more active colloid so as to counteract, sometimes completely according to their nature and relative concentration, the effect of the second on the surface tension of the solution. This explains why, in jaundice, relatively large amounts of sodium glycocholate and taurocholate can exist in the circulation without causing hemolysis of the whole blood.

II

ACTION OF COLLOIDS ON THE CRYSTALLIZATION OF SALTS

It has been shown in a previous paper[4] that col-

[1] du Noüy, P. L., "Surface Equilibrium of Colloidal Solutions. I.," SCIENCE, 1924, Vol. LIX, No. 1539, p. 580.

[2] *Compt. rend. Acad.*, 1922, clxxiv, 1258; *Compt. rend. Soc. biol.*, 1924, lxxxix, 1148.

[3] du Noüy, P. L., *J. Gen. Phys.*, 1919, i, 521; *La Nature*, 1920, No. 2391, p. 63. Holmes, H. N., "Manual of Colloidal Chemistry," New York, Wiley, 1922.

[4] du Noüy, P. L., *J. Exp. Med.*, 1922, xxxv, 732; *Compt. rend. Acad.*, 1922, clxxiv, 963.

loids in solution will become adsorbed in the surface layer in function of the time. When salts, NaCl, for example, are contained in the solution, the dissociated ions are adsorbed on the micellae or molecules of the colloid, and carried to the surface of adsorption, thus decreasing to a considerable extent the concentration of salts in the solution. In other words, when colloids are present with salts in a solution, the concentration of salts in the bulk of the liquid, according to Gibbs's law, does not occur. On the contrary, the salts are concentrated in the surface layers, together with the colloids. This explains the precipitation of colloids at interfaces and the formation of membranes.[4] The experimental illustration of this fact is made as follows:

Solutions of different colloids (serum, albumins, gum arabic, saponin, dyes, etc.) are prepared in saline solution (NaCl 0.9 per cent.). The following concentrations are then placed in watch-glasses, carefully cleaned: 10^{-1}, 10^{-2}, 10^{-3}, 10^{-4}, 10^{-5} and intermediate values up to 10^{-7}. Pure NaCl solution is also placed in watch-glasses as a control. After evaporation, the pure saline solution shows large, well-formed NaCl crystals at the bottom of the watch-glass, while the watch-glasses containing the colloids exhibit a large opaque white disk, with a dark area in the center. The white disk is made of minute NaCl crystals, so small as to give the impression of smooth white paint. At the bottom, instead of large crystals, a few small scattered crystals are seen, showing that the crystalloid could not concentrate in the bulk. The diameter of the white disk is almost that of the solution before evaporation, showing that, as it evaporated, the liquid abandoned progressively on the glass the colloid and the salt concentrated in the surface. The phenomenon with saponin is very clear up to a concentration of saponin of 1×10^{-7} gms per cc (1/10,000,000), and with proteins up to (1/4,000,000) (NaCl concentration of 1 per cent.).

At a given concentration (10^{-2} for serum, 10^{-3} for saponin and sodium oleate), periodic rings consisting of small crystals are observed on the watch-glass, a little over 1 mm apart. These experiments show very clearly the adsorption of crystalloids by colloids in the same solution.

P. LECOMTE DU NOÜY

THE ROCKEFELLER INSTITUTE FOR MEDICAL RESEARCH

BREEDING HABITS AND MUTATIONS IN THE MOTH-LIKE FLY (PSYCHODA)

DURING the last eighteen months I have been engaged in studying the breeding habits and life history of a moth-like fly (Psychoda alternata) with the view of determining whether the form might not be used in studies in genetics. The effort has been attended with unusual success both in breeding the flies and in the discovery of at least one mutation.

Culture methods and life history: The adults are minute, hairy animals about two millimeters in length. They ordinarily breed in decaying vegetation, but dung from either horses or cattle has proved to be an excellent medium. Breeding takes place readily under laboratory conditions, the life cycle being completed in from twelve to sixteen days. Adult females are favorably stimulated by the culture medium, so that ovipositing takes place quickly. The eggs hatch in a little less than two days into active, eyed larvae resembling those of midges. The larvae feed for about ten days, after which they become quiescent and pupate. Adults emerge two days later and complete the life cycle.

Pedigreed strains are being maintained in test tubes and small flasks, while battery jars are being employed for large mass cultures.

A second species of moth-like fly (psychoda minuta) is being bred successfully under conditions similar to but somewhat more difficult than the first.

Mutations: Several mutations have appeared which reoccur regularly and a number of fluctuating variations have been induced by altering conditions of temperature and moisture. The most striking mutation has been studied in detail especially as to its method of inheritance, and it has been found to behave as a simple Mendelian recessive. The normal, wild fly has a reddish-brown pigment in the lens of each ommatidium, giving a reddish-brown color to the entire compound eye. The pigment is also found in the Malpighian tubules from the earliest stage in which the tubules may be distinguished and the ocelli of the larvae are also colored reddish-brown. In the mutant the pigment is lacking, so that the adults are white-eyed except for the pigment between the ommatidia and colorless Malpighian tubules appear in larvae, pupae and adults. The larvae also have colorless ocelli. This mutation breeds true and has been carried through forty-eight generations with no indication of a return to the normal condition.

Two other mutations have appeared and their methods of inheritance are being studied.

Because of the ease with which this fly is bred and handled, its short life history and its possibilities in the production of mutations it is predicted that the form will become very useful in the study of heredity.

Articles with figures and photographs are being prepared dealing with the life history and culture methods, with the white-eyed mutation and its method

of inheritance and with the phototropic reactions of the normal and mutant flies.

ZOOLOGICAL LABORATORY, BELOIT COLLEGE C. L. TURNER

THE IOWA ACADEMY OF SCIENCE

THE thirty-eighth annual meeting of the Iowa Academy of Science was held at the Iowa State College, Ames, Iowa, May 2 and 3, 1924. The associated societies, Iowa Section, Mathematical Association of America, Ames and Iowa Sections of the American Chemical Society, and the Iowa State College Branch, Society of American Bacteriologists, held their sectional meetings in connection with the Academy.

The meeting was especially commemorative of President L. H. Pammel's thirty-five years of service in the state, and several of the papers and addresses were in review of the scientific work of that period. Special features of the meeting were addresses by Dr. William Trelease, of the Illinois State University, on "Personal recollections of some North American botanists," and by Dr. Herbert Osborn, of the Ohio State University, on "Recollections of early workers in entomology and zoology," a paper on "The early history of the Iowa Academy," by Dr. D. S. Fairchild, of Clinton, and the presidential address by Dr. L. H. Pammel, of the Iowa State College, on "A century of botany in Iowa."

Officers were elected as follows: *President,* O. H. Smith, Cornell College; *vice-president,* R. I. Cratty, State College; *secretary,* P. S. Helmick, Drake University; *treasurer,* A. O. Thomas, State University; *representative to A. A. A. S.,* D. W. Morehouse, Drake University.

The sectional chairmen for the ensuing year are: *Bacteriology,* Paul Emerson, State College; *botany,* H. E. Jaques, Iowa Wesleyan College; *chemistry,* H. F. Lewis, Cornell College; *geology,* W. F. V. Leicht, Simpson College; *mathematics,* E. R. Smith, State College; *physics,* P. S. Helmick, Drake University; *zoology,* Dayton Stoner, State University.

The following papers were presented:

BACTERIOLOGY[1]

(Iowa State College Branch, Society of American Bacteriologists.)

The application of electronic theory in its applications to oxidation-reduction potentials in bacteriology: F. E. BROWN.

The problem of stream pollution in Iowa: H. V. PEDERSON.

Production of hydrogen sulfide by members of the colon group of bacteria: FRED S. PAINE.

Utilization of chinic acid in the differentiation of the colon-aerogenes groups: Demonstration. B. H. BUTCHER.

Some observations on the Voges-Proskauer reaction: CLAIR S. LINTON.

The epizoology of an outbreak of anthrax in Iowa: C. D. RICE.

Nutrose medium as a substitute for sugar-free broth in the study of carbohydrate fermentation: S. H. MCNUTT and PAUL PURWIN.

The diagnosis of bacillary white diarrhœa in chicks: CHAS. MURRAY.

Studies on the Morgan group of paratyphoids: JOHN WELDIN and A. G. AJWANI.

Food preservation and so-called "food poisoning": G. G. DEBORD.

The need of organizations of those engaged in laboratory diagnosis: ROSS L. LAYBOURNE.

A proposed grouping of the yeasts common in dairy products: M. P. BAKER.

Variations in the S. lactus group: B. W. HAMMER.

The present status of Wildier's bios: E. I. FULMER.

Theory of dye utilization in bacteriological media: Demonstration. C. H. WERKMAN.

Notes on the fungus flora of Iowa soils: E. V. ABBOTT.

Home economics bacteriology as a field for research: CLARISSA CLARK.

A schematic arrangement for the classification of laboratory media: H. W. SCHOENLEN.

A green nonfluorescent organism isolated from creamery wastes: LULU SOPPELAND.

Acidity as a factor in the purification of creamery wastes: MAX LEVINE and LULU SOPPELAND.

BOTANY

The work of Dr. Pammel at the State College: A. T. ERWIN.

The house fungus, Merulius lacrymans: W. H. DAVIS.

The genus Physalis in Iowa: O. E. ELMER.

Quercitron oak and its relation to soils: RAYMOND J. BECRAFT.

Distribution of plants on upper Skunk River, Iowa: RAYMOND J. BECRAFT.

Ecological notes in the Arapahoe Mountains near Frazer, Colorado: L. H. PAMMEL.

The Uredinales of Iowa: J. C. ARTHUR.

The tropograph and flectograph: WALTER J. HIMMEL.

The physiological barometer: RAYMOND WALLACE.

The physiology of growth: CLIFFORD H. FARR.

Certain features of the vegetation in Kansas sand hills: FRED W. EMERSON.

A ten-years' phenological record of the spring flowering plants: H. E. JAQUES.

Further studies of the germination of woody plants: L. H. PAMMEL and CHARLOTTE M. KING.

Viability tests of stored corn of different ages: MISS CHARLOTTE M. KING.

Comparative anatomy of Hubam and biennial sweet clover: MISS ALICE M. CROZIER.

The Polyporaceae of Iowa: ROBERT E. FENNELL.

Comparative rates of imbibition in apple wood tissue: CHARLES F. ROGERS.

[1] Abstracts of these papers will be found in the *Journal of Bacteriology.*

Lilium michiganense in Iowa: Wier R. Mills.

At what depth should clover seeds be planted? Winfield Scott.

What is the absolute value of the prevailing method of selecting kernels from ears of seed corn for testing purposes? Professor Winfield Scott.

The morphology of Basidiophora Kellermanii: Guy West Wilson.

Notes on some Colorado and Wyoming fungi: Professor Guy West Wilson.

Species crosses in the genus Cucurbita: Edward F. Castetter.

Iowa plant notes: R. I. Cratty.

The genus Rumex in Iowa: Mr. Cratty.

Hybrid oaks in Iowa: B. Shimer.

Prairie slopes on the bluffs of Mississippi River: Professor Shimek.

Genetic linkage between chlorophyll and carotinoid pigments in maize: E. W. Lindstrom.

Inheritance of carbohydrates and fat in corn: E. W. Lindstrom and F. Gerhardt.

General relation of endosperm and chlorophyll characters in maize: W. A. Carver. (Introduced by E. W. Lindstrom.)

The chemical composition of wheat seedlings: L. Edwin Yocum.

Response of the genus Rhamnus to Puccinia coronata Corda: S. M. Dietz.

Breeding oats resistant to Puccinia graminis avenea: Mr. Dietz.

Some winter flowering plants: William Poulter.

Chemistry

(Ames and Iowa Sections, American Chemical Society.)

Physical Chemistry

Adsorption from salt solutions by colloidal copper ferrocyanide: Mikkel Frankert and J. A. Wilkinson.

A method of measuring rates of corrosion: E. Lee Henderson, C. E. Stanwart and G. H. Brodie.

Structural evidence of an iron-carbon eutectoid: H. E. Flanders and Anson Hayes.

The solubility in austinite of carbon from carbon and of carbon from cementite: H. L. Maxwell and Anson Hayes.

Compressions as a factor in causing deviations of the system alcohol-water from Raoults' law: W. H. Jennings and Anson Hayes.

The physical properties of some "short period anneal" products of white cast iron: Anson Hayes and W. J. Diederichs.

Determination of the colloidal material in soils: D. Verne Moses.

The electrometric determination of lime: H. V. Wright and R. B. Morris.

The preparation of activated carbon from furfural residues: Galen Hunt.

The use of the audion tube in chemical measurements: Edwin Kurtz.

The free energy of dilution and the activity of the ions in aqueous solutions of barium chloride: J. N. Pearce and Ralph W. Gelbach.

The partial molal volumes of certain anions of organic acids: J. N. Pearce and F. E. Ware.

Analytical Chemistry

The effect of pressure on the rate of decomposition of potassium chlorate-manganese dioxide mixtures: F. E. Brown and H. M. McLaughlin.

Spontaneous decomposition temperatures of potassium chlorate-iron oxide mixtures: F. E. Brown and W. C. O. White.

Some increases in potential of calomel electrode-oxidizing agent—platinum electrode cells on adding reducing agents: W. S. Hendrixson.

The incomplete oxidation of sulfurous acid by some oxidants: Professor Hendrixson.

A study of the substances in rain and snow: Nicholas Knight.

Bio-Chemistry

Feeding potassium iodide to young growing swine: John M. Evvard.

Some observations on the effect of iodine administration on sheep: J. M. Evvard, A. R. Lamb, W. G. Gaessler.

The rôle of rye in the Vienna process for the manufacture of yeast: E. I. Fulmer and Roma Elmer.

Certain maxims to be observed in the study of the nutrition of microorganisms: Professor Fulmer.

Relation of diet to reproduction and rearing of young: L. T. Anderegg.

Observations on the nutritive value of skimmed milk powder: Professor Anderegg.

The possibility of a new vitamine for reproduction: V. G. Heller.

Metabolism and vitamine A: C. McCay and V. E. Nelson.

Industrial Chemistry

Effect of natural alkali waters on concrete: Geo. A. Burke.

Possible uses for waste chlorine: O. R. Sweeney and J. W. Hussey.

The manufacture of oxalic acid from corn cobs: H. A. Webber.

Studies on the commercial preparation of chlorates: H. A. Christopherson.

The preparation of zeolytic water softening materials: E. L. Barthel.

The bleaching of soy bean oil with peat: H. V. Wright and G. A. Pierce.

Method of preparing silica absorbents: O. R. Sweeney, F. Pfeffer and A. L. Redstone.

The preparation of permanent porcelain and quartz mats for Gooch crucibles: G. N. Quam and H. V. Wright.

The preparation of activated carbon from furfural residues: Galen Hunt.

Chemical engineering and agriculture: Julian E. MacFarland.

Magnesia crucibles in an arc furnace: EDMOND E. MOORE and ANSON HAYES.

Food Chemistry

Relation of starch to the strength of wheat flour: G. G. NAUDAIN and J. H. BUCHANAN.

Organic Chemistry

A comparative study of the removal of cotton seed and corn oil stains from wool and silk: RUTH O'BRIEN and BARBARA WENTCH.

Action of thionyl chloride on diacetone glucose: J. B. ALLISON.

Some recent studies concerning organometallic compounds: H. H. PARKER, F. SCHULZE, W. B. KING, J. M. PETERSON and H. GILMAN.

Conclusions in regard to the methylation of phenol: H. F. LEWIS and WESLEY J. TREESCH.

Note on the hydrolysis of benzene: H. F. LEWIS and J. W. THIESSEN.

The relation of substituents in the hydrocarbon radicals to the formation and reactions of certain mixed ethers: L. CHAS. RAIFORD and J. C. COLBERT.

Chemical Education

A simple automatic mercury pump which permits the collection of the exhaust gas: H. M. MCLAUGHLIN and F. E. BROWN.

Chemistry Department, Iowa State College, its equipment and organization: W. F. COOVER.

A comparison of the grades in chemistry made by pupils who were taught by the same instructor in recitation and laboratory with the grades of pupils who were taught by different instructors in recitation and laboratory: F. E. BROWN and KENNETH L. BIRD.

The content of chemistry courses based on data secured by the Iowa Committee on the Correlation of College and High School Chemistry: P. A. BOND.

A "painless" method for the preparation of chlorine: JACOB CORNOG.

GEOLOGY AND ETHNOLOGY

A dust-fall in Iowa on March 29, 1924: EARL T. APFEL.

Geology of the region about Belton in northwestern Montana: ROBERT H. SEASHORE.

The Apache region, Arizona and its Indians: (By title) ALBERT B. REAGAN.

An Indian quartzite quarry near Hot Springs, South Dakota: PAUL ROWE.

The Algona recessional stages of Wisconsin glaciation in Iowa: JOHN E. SMITH.

The Fort Dodge stages in the retreat of the glaciers: PROFESSOR SMITH.

A preliminary state map of the Wisconsin glacial till: PROFESSOR SMITH.

Some theoretical stages in the retreat of the Iowan ice sheets: PROFESSOR SMITH.

The fauna of the state quarry beds: (Illustrations), M. A. STAINBROOK and H. S. LADD.

Notes on the geology of Jackson county: HENRY S. LADD.

The physiography of southwestern North Dakota: PHILIP B. KING (Introduced by A. O. Thomas).

An intra-Cedar Valley unconformity in Johnson county: WALTER V. SEARIGHT and MAX LITTLEFIELD.

A light colored zone of subsoil in southern Iowa: W. G. BAKER.

The relation of Aftonian peat beds to the Nebraskan gumbotil plain: GEORGE F. KAY.

A fossil pine cone from drift of northern Iowa (Illustrations): A. O. THOMAS.

Some goniatites from the Paleozoic of Iowa (Illustrations): PROFESSOR THOMAS.

Pleistocene mammalian remains recently found in Iowa (Illustrations): PROFESSOR THOMAS.

Ascent of Mt. Namosi, Fiji, (Illustrations): WALDO S. GLOCK (Read by PROFESSOR THOMAS).

A section in some late Tertiary and Quaternary marls near De Land, Florida (Illustrations): THOMAS H. MACBRIDE (Read by PROFESSOR THOMAS).

Application of term Pennsylvanian to Iowa Coal Measures: CHARLES KEYES.

Recent light on the meaning of early Devonian hiatus: DR. KEYES.

Eastern extension of western deserts in Iowa: DR. KEYES.

The deep water-well at Brighton: J. M. LINDLY.

MATHEMATICS[2]

(Iowa Section, Mathematical Association of America).

Reduction of the equation of the general conic section: W. J. RUSK.

The preparation of high school teachers of mathematics in Iowa: E. W. CHITTENDEN and F. M. WEIDA.

On the meaning, evaluation and application of the refund integral: F. M. WEIDA.

The zeros of the function $f^k(z) = \sum_{n=0}^{\infty} n^k \frac{z_n}{n!}$ *where k is a positive integer:* JULIA T. COLPITTS.

Note on the average family of brothers and sisters of the boys in families of n children: H. L. RIETZ.

Relation of surface level of a rotating fluid to the shape of its container: EDWARD S. ALLEN.

Determination of the foci and directrices of a conic section: EDWARD S. ALLEN.

Construction of the tangents of an ellipse: EDWARD S. ALLEN.

A problem in mathematics teaching: F. M. MCGAW.

The isobaric differential equation in an elementary course: JOHN F. REILLY.

A new interpolation formula: JOHN F. REILLY.

A theorem in spherical trigonometry: J. S. TURNER.

A new property of the circle: J. S. TURNER.

A theorem in geometry: ROSCOE WOODS.

The solution of q-difference equations by means of infinite determinants: E. R. SMITH.

Certain transformations of frequency distributions: G. W. SNEDECOR.

[2] Abstracts of these papers are published in *The American Mathematical Monthly.*

PHYSICS

Rainbow and other atmospheric phenomena: (By title) MRS. F. MAY TUTTLE.

Is Iowa getting wetter or drier? CHARLES D. REED.

A note on daylight requirement: WM. KUNERTH.

Orientation of buildings on the basis of sunlight: PROFESSOR KUNERTH.

Preliminary report on the optical properties of magnesium: M. E. GRABER.

Balmer lines from hydrogen in certain gases: E. O. HULBERT.

On the theory of the refraction of X-rays: PROFESSOR HULBERT.

On the breadth of the hydrogen lines in the stellar spectra: PROFESSOR HULBERT.

The Balmer absorption series of hydrogen: PROFESSOR HULBERT.

The absorption lines in the spectrum of the metallic spark in water: PROFESSOR HULBERT.

Phenomena of cathode sputtering: K. V. MANNING.

Electrical constants of dielectrics for radio frequency: R. V. GUTHRIE.

Torques and forces between coils carrying currents of high radio frequency: T. A. HUNTER.

A note on the theory of x-ray diffraction in liquids and amorphous solids by Raman and Ramana han: E. H. COLLINS.

Magnetic properties of evaporated iron films: A. J. SORENSEN.

The action of a Helmholtz resonator in a branch line: G. W. STEWART.

Measurement of the acoustic impedance of a branch line: PROFESSOR STEWART.

Note on the theory of the optimum angle of a conical horn: PROFESSOR STEWART.

The Hall effect and specific resistance in evaporated films of nickel, cobalt, palladium and platinum: H. B. PEACOCK.

The theory of megaphones and receiving horns: G. W. STEWART and G. R. BUTZ.

The M absorption limits in the tungsten x-ray spectrum: R. V. ZUMSTEIN.

Sparkless discharge of electrified silks and woolens: JAY W. WOODROW.

Maxwell's treatment of networks applied to the delta connection of a three-phase power service: ALFRED W. MEYER.

The relative values of selenium cell and ionization methods of measuring x-rays in Roentgenotherapy: ARTHUR W. ERSKINE AND SCOTT W. SMITH, JR.

A theoretical discussion of the intrinsic intensity and percentage of polarization of light passing through deep slits: L. P. SIEG.

The effect of the material composing the sides of deep slits on the intrinsic intensity of light transmitted through the slits: C. R. SMITH. (Introduced by L. P. Sieg.)

On the optical constants of selenium and of tellurium in the blue and ultraviolet regions of the spectrum: R. F. MILLER. (Introduced by L. P. Sieg).

An experiment in effective resistance as a function of eddy current and hysteresin losses: C. J. LAPP.

New charts of radioactive data: PROFESSOR LAPP.

A search for element 61: MESSRS. HOPKINS, LAPP AND R. A. ROGERS.

Electric arc method of making x-ray targets: MESSRS. LAPP AND ROGERS.

A method for the production of longitudinal sound vibration in a rod: W. D. CROZIER.

A simple method of determining horizontal intensity of the earth's magnetic field: E. P. T. TYNDALL.

GENETICS, PSYCHOLOGY AND ZOOLOGY

Is the quality of our high school students deteriorating? C. C. ROSS.

The content of a course in child study for girls not intending to teach: THOMAS F. VANCE.

The various methods used to examine students and the relative merits of those methods: J. E. EVANS.

Results of the testing program given at State College: MISS NORA KLISE.

The differential death rate of sexes in animals, with a suggested explanation: S. W. GEISER.

Notes on the biology of Eutettix strobi (Homoptera, Cicadellidae): F. A. FENTON.

Arsenical poisoning in tomato plants: PROFESSOR FENTON.

A study of the movements of the empty stomach in the mollusca: T. L. PATTERSON.

The lateral line organs of the shovel-nose sturgeon, distribution and innervation: H. W. NORRIS.

Keeping Iowa's waters pure: GEORGE BENNETT.

A preliminary list of the bees of Iowa—The genus Halictus: RALPH L. PARKER and FREDERICK A. FENTON.

The Odonata of Henry county: CHARLES HOFFMAN.

Birds of Wapello county, Iowa: CHARLES J. SPIKER.

Notes on the Oyster-Shell Scale, Lepidosaphes ulmi Linn: R. L. WEBSTER.

Photochemical distribution on the retina as shown by the perimeter: F. M. BALDWIN.

The effect of vitamin deficiency on blood pressure in rats: H. B. COOK and F. M. BALDWIN.

Snake notes: J. E. GUTHRIE.

Simple versus complex mineral mixtures for young growing swine: JOHN M. EVVARD, C. C. CULBERTSON and W. E. HAMMOND.

Trapping birds at Iowa City during 1923: DAYTON STONER.

The fourth volume of the first edition of Holbrook's "North American Herpetology": B. SHIMEK.

Three different types of genetic sterility in the parasitic wasp Habrobracon: P. W. WHITING. Drawings.

Two generations of selection with reference to the inheritance of scurvy resistance in guinea-pigs: W. V. LAMBERT. Charts.

Results of selective breeding in the parasitic wasp Habrobracon: U. A. HAUBER.

New measurements in the process of reading: E. O. FINKENBINDER.

P. S. HELMICK,
Secretary